Physics I 5th Block September 11, 2015

One Dimensional Motion Lab Report

Background: We do not tend to analyze motion in our day-to-day activities; we just see it as motion and nothing else. To fully understand motion from the physics point-of-view, several concepts have to be defined and well learned. In this experiment we will be analyzing the simplest form of motion: one-dimensional motion. Before we get to how fast an object moves, we first need to know how much it has moved from its starting point: this is referred to as displacement (Δx), and how long it takes for that movement to actually occur: time interval (Δt). Having understood these two concepts, we can now introduce the concepts of average velocity and average acceleration. Average velocity is the displacement of an object divided by the time interval. We usually associate speed and velocity as one, however another characteristic of velocity is that it not only has a value, but also a direction (unlike speed). On the other hand, average acceleration will refer to the rate of change of velocity; also being formed by a value and its direction. So if an object were to have a constant velocity, it would have no acceleration whatsoever.

Objective: The objective of this experiment is to be able to further our understanding of the previously mentioned concepts by having to use them often and knowing in which situation to apply them. Furthermore, this laboratory also serves as a medium to which we will be able to master the process of figuring out the velocity and acceleration of an object by having to recognize which formulas and calculations to use in order to obtain them. Additionally, through this testing we will be able to see the correlation that the graphs will have with the behavior of the object's motion. And lastly, we will gain a further sense of how motion, displacement, velocity, acceleration, and time interval are seen in simple tasks such as walking.

Procedure:

1. Measure out 5 meters marking a starting point and each interval meter.
2. The Walker will walk at a constant rate from start to finish.
3. Begin timer the moment the Walker begins motion and stop timer as the Walker passes each interval mark. You must stop your timer as the Walker passes the designated mark so if you miss the mark you must redo the trial.
4. Record the time on a sheet of paper labeled as trial 1.
5. Repeat steps until you get three good trials.
6. **Repeat procedure with the Walker moving with an acceleration**

Data:

Constant Motion Data				
Position (m)	**Time (s)**			
	Trial 1	*Trial 2*	*Trial 3*	*Average*
0	0	0	0	0
1	1.03	1.20	1.40	1.21
2	2.13	2.11	2.35	2.19
3	2.96	2.83	2.88	2.89
4	4.14	4.48	3.85	4.16
5	5.20	4.73	4.88	4.94

Accelerating Motion Data				
Position (m)	**Time (s)**			
	Trial 1	*Trial 2*	*Trial 3*	*Average*
0	0	0	0	0
1	1.63	1.64	1.49	1.59
2	2.76	2.60	2.32	2.56
3	3.36	3.36	2.96	3.23
4	4.11	3.89	3.42	3.80
5	4.43	4.22	3.83	4.16

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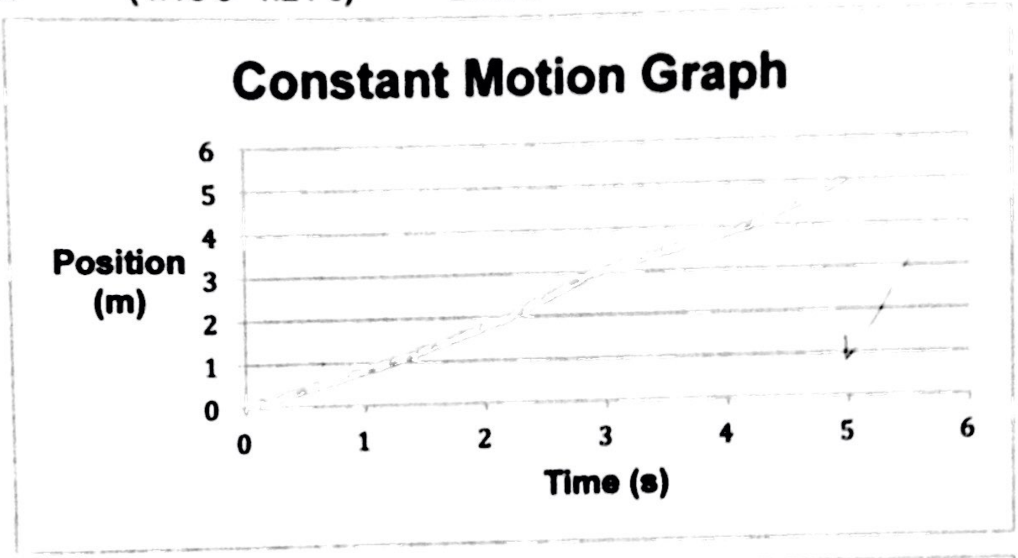
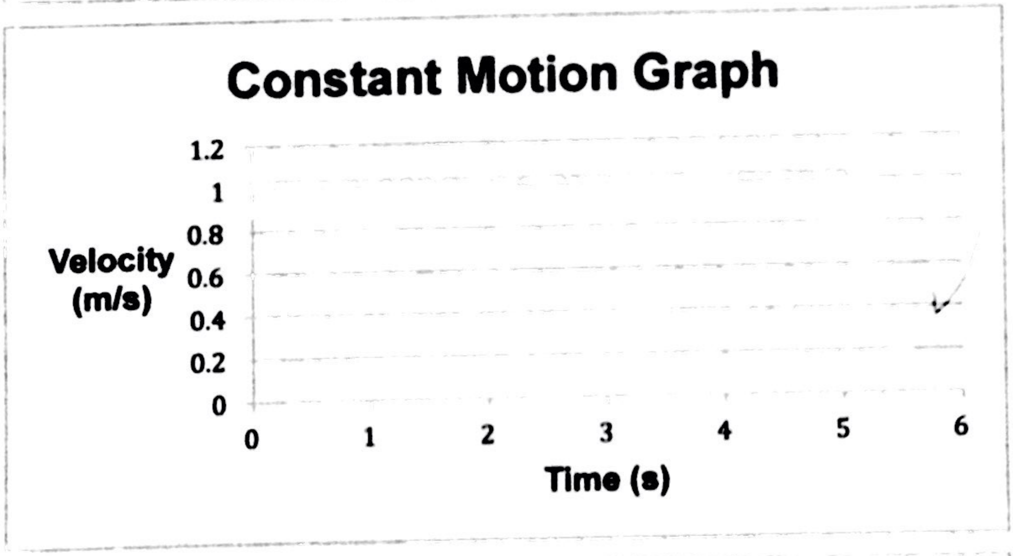
Calculations:

$$V_{avg} = \frac{\Delta X}{\Delta t} = \frac{(4m - 1m)}{(4.16\ s - 1.21\ s)} = \frac{3m}{2.95\ s} = 1.02\ m/s$$

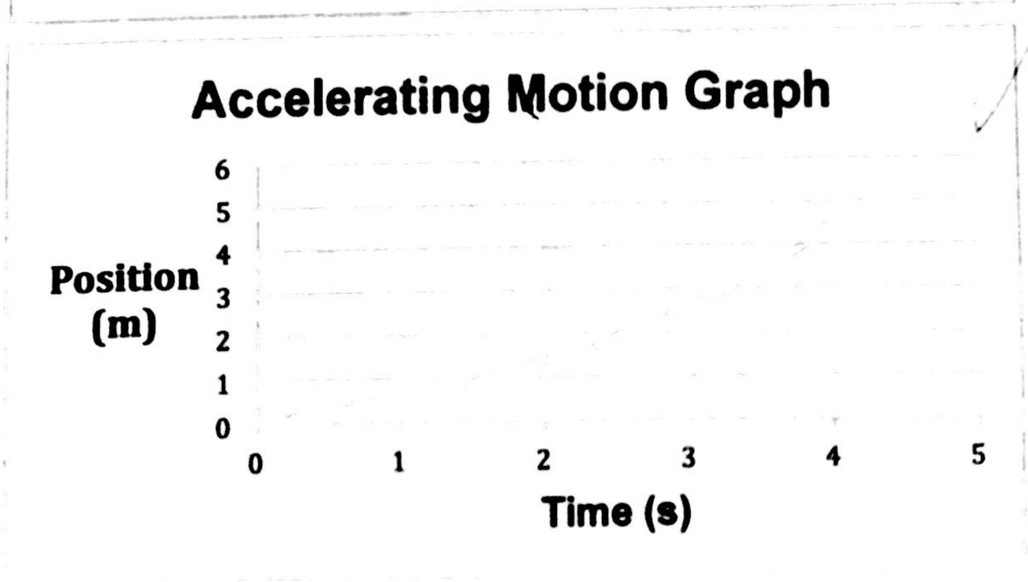
Graph #1



Graph #2



Graph #3



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Conclusion: After analyzing and plotting the data, there are several conclusions that can be made. In the constant motion segment of our experiment, we were able to stay quite consistent as the displacement increased; however, we were not able to have the exact same time interval in between each meter. This can be seen in the shape of the line in graph number one. Although it follows an incline in the positive direction, the line itself is not perfectly straight. This could be due to either errors while establishing our frame of reference – which in this case it was the five meter "ruler" that we traced on the floor- could also be due to the slight variation in our reaction time in clicking the stopwatch right when we see the Walker reach the desired distance (with 5 meters being the maximum displacement measured), slight changes in the pace to which the Walker is advancing, etc. Nonetheless, we got a clear picture on how a position vs. time graph should look like under a constant velocity. Furthermore, by having to actually find the average velocity, we got to practice our knowledge about the specific formulas that pertain with each variable that we are trying to obtain. In the second graph, we are able to connect both the concept of velocity and acceleration. By analyzing the shape of the velocity vs. time graph – which would be a horizontal line with the average velocity value previously calculated - we can determine that the velocity is going in a positive direction, and that it experiences no acceleration at all. Next, in the accelerated motion part of our laboratory experiment, we are presented with a new shape in our graph that with some analysis reveals that indeed our motion was accelerating. We need to break down graph number three in order to fully understand each characteristic. We can determine that the velocity of this graph has to be positive because it is in the positive side of the axes. We can also determine that the velocity is no longer constant, this revealed to us by its curved shape. And if we apply our knowledge about the definition of acceleration (which is the rate of change of velocity), we should know that now the object is indeed experiencing a positive acceleration. Additionally, this could bring us to another conclusion: if the directions (either positive or negative) of both the velocity and acceleration are the same, the object should be speeding up. If the directions are opposites of each other, the object should be slowing down. In the end, the knowledge and especially the practice gained during this experiment allowed us to have a firm grasp of each term and its definition, to be able to create a mental map on how a graph should look like under each scenario, made us more proficient when it comes to using calculations, and overall showed us a side of motion that we would never have explored if we had not done this.